# AFRL's RAD6000 Computer

FACT SHEET Air Force Research Laboratory Space Vehicles Directorate 505.846.4704/4321 www.vs.afrl.af.mil

AFRL'S Rad6000 is the world's first radiation-hardened 32-bit microprocessor, containing more than one million transistors. The Rad6000 was manufactured for the Air Force by BAE systems.

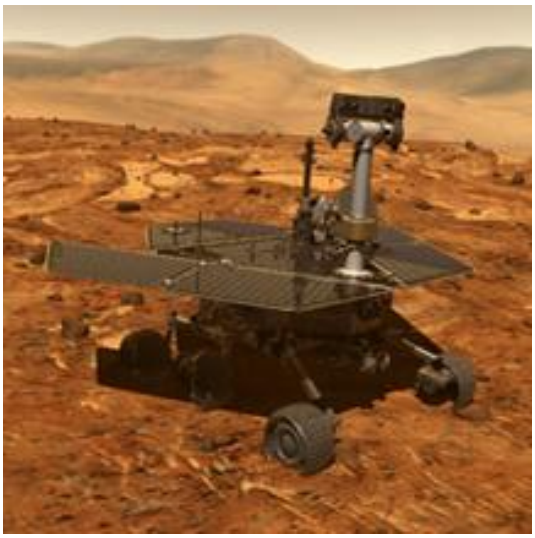
The Rad6000 computer was used to orchestrate the NASA's Mars Exploration Rovers, Spirit and Opportunity to Mars in January 2004. The Rovers moved about the planet searching for signs that water might once have existed on the red planet.

NASA chose AFRL's microprocessors because they are proven reliable, rugged, and fully compatible with their systems. These computers can withstand the harsh radiation environment of space and operate reliably over long-term missions. They control all data stream telemetry between the spacecraft and controllers on the ground.

Like neural connections in the human brain, transistors inside computer chips help manage the flow of electrical energy by directing it through a maze of silicon-based circuits. Transistors act like switches at electronic junctions to speed electrons to their intended destinations so that desired spacecraft and rover functions can be performed.

Constant bombardment by radiation, however, generates unwanted electrical charges inside transistors, building to the point that the transistor, or switch, can no longer control the electron flow. Consequently, overcharged transistors shut down, and failed electronics mean dead missions and the loss of hundreds of millions of dollars. Much of AFRL's work in electronic spacecraft components prevents such losses.

AFRL's Space Vehicles has made significant investments into radiation hardening fabrication technologies and the space electronics based on them. Contractor such as BAE Systems and others now have the ability to manufacture such devices, which results in better products for the Air Force, NASA, the Defense Department, as well as the commercial customer.



The Defense Department and NASA used to pay from $50 million to $100 million for each processor in development and manufacturing costs. With AFRL's involvement, the price of a typical processing module dropped to between $500 thousand and $2 million and is available as off-the-shelf hardware. An additional value of AFRL's help in transforming and transferring technology to military and civilian users, maximizes taxpayer investment.

The Air Force and industry team has also increased the life span for spacecraft missions by making electronic systems such as microprocessors more resilient to the catastrophic effects of radiation.

More than 60 Air Force, Defense Department, NASA, and commercial space systems are now using this technology and better than 90 percent of satellites launched today rely on radiation-hardened processors developed by AFRL's Space Vehicles.

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